

*THE INFLUENCE OF MATCHING AND MOTOR-IMITATION
ABILITIES ON RAPID ACQUISITION OF MANUAL SIGNS AND
EXCHANGE-BASED COMMUNICATIVE RESPONSES*

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Establishing a relation between existing skills and acquisition of communicative responses may be useful in guiding selection of alternative communication systems. Matching and motor-imitation skills were assessed for 6 children with developmental disabilities, followed by training to request the same set of preferred items using exchange-based communication and manual signs. Three participants displayed both skills and rapidly acquired both communicative response forms. Three others displayed neither skill; 1 mastered exchange-based responses but not manual signs, and neither of the other 2 easily acquired either response form.

DESCRIPTORS: alternative and augmentative communication, autism, matching to sample, motor imitation

Manual signing and exchange-based communication (EBC), in which the individual hands a graphic symbol to the communicative partner (Gutierrez et al., 2007; Sigafoos, Ganz, O'Reilly, Lancioni, & Schlosser, 2007), are alternative communication systems often taught to persons with developmental disabilities and

speech deficits. Three recent investigations compared acquisition of a small number of mands by the same individuals using both systems. EBC was acquired more rapidly in two of the studies (Adkins & Axelrod, 2001; Chambers & Rehfeldt, 2003); however, Tincani (2004) observed that EBC resulted in a higher percentage of independent mands for 1 child but not for a 2nd child who exhibited relatively better preexisting motor-imitation abilities. Tincani suggested that "acquisition of picture exchange and sign language may vary as a function of ... motor imitation skills prior to intervention" (p. 152).

The present study also assessed correspondence between motor-imitation skills and acquisition of both manual signs and EBC. It departed from Tincani (2004) in that (a) attempts were made to teach participants to request the same items in both communicative

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forms to ensure that different outcomes were not attributable to differences in stimulus quality, and (b) correspondence was also examined between acquisition and simple matching abilities (matching a sample stimulus to an identical comparison stimulus), which may be important in acquisition of selection-based communication systems like EBC (Miranda & Datillo, 1987).

METHOD

Participants, Setting, and Materials

The participants were 6 children, 7 to 17 years old, who had been admitted to a hospital unit for individuals with behavior disorders. Each had been diagnosed with an autism spectrum disorder and mental retardation. Vineland Adaptive Behavior Scales scores revealed age equivalences of no more than 2 years 6 months in receptive, expressive, and total communication domains. Information on prior language-training attempts was unavailable, but each participant was included because he or she demonstrated little or no functional language. Sessions were conducted in the living area or a bedroom of the unit, which contained tables, chairs, and materials required for each activity. Preference assessments (Fisher *et al.*, 1992) were used to identify preferred edible items for each participant.

Skills Assessments

Matching assessment. Before the matching assessment, 10 trials were conducted to ensure that the participant had the minimal motor skills to place one card on another. The cards depicted the same single number or letter. The therapist first modeled the correct response by placing one card atop the other and saying, "match to same." During each subsequent trial, the therapist placed one card in front of the child, gave the child the other card, repeated the verbal prompt, gave the participant the opportunity to respond, and delivered praise and an edible item for correct responses. If the

participant did not respond within 5 s or made an incorrect response, the therapist repeated the verbal prompt and modeled the correct response. If the participant again did not make a correct response, the therapist repeated the verbal prompt and physically guided the correct response. Praise and an edible item were delivered for correct responses after any prompt, but an independent correct response was scored only after correct responses that followed the initial verbal prompt. All participants responded correctly on at least 90% of trials. Identical procedures were then used during the subsequent 10-trial matching assessment, except that the therapist placed three picture cards in a row in front of the participant, approximately 10 cm apart. During each trial, the therapist handed the participant a fourth card that was identical to one of the cards on the table and began the prompt sequence.

Motor-imitation assessment. The motor-imitation test also included 10 trials. The unit's educational specialists generated a list of simple movements they commonly included in educational plans that targeted fine- and gross-motor movement. Five gross-motor movements (e.g., touching the head) and five fine-motor movements (e.g., holding up a specific number of fingers) were selected from this list for each participant. At the start of each trial, the therapist modeled a movement and said, "Do this." If the child responded incorrectly or did not respond, the therapist repeated the prompts. A second failure to respond correctly resulted in physical guidance to make the correct movement. The therapist delivered praise and an edible item after a correct response following any prompt, but the observer scored an independent correct response only after correct imitation of one of the model prompts.

Communication Training

Each individual received training sessions in both systems. Three consecutive sign-training sessions and three consecutive EBC training sessions were conducted per day, 4 days per

week, with the order reversed on alternating days. Sessions involved 10 trials. Training continued with each system until the participant mastered four mands (defined as 90% or greater independent correct responses over three consecutive sessions) or until at least 15 sessions were conducted without mastery of the first response.

Exchange-based communication training. During EBC training sessions, the participant and therapist were seated at a table, and a card (a line drawing, colored picture of the preferred edible item) and corresponding item were placed in front of the child (the item was in the participant's view during all sessions). Prior to the first trial, the therapist stated the contingencies for that session ("If you want X, you have to hand me the X card like this."), physically guided the participant through a single trial, and delivered the item. Training trials immediately followed this first demonstration. At the beginning of each trial, the therapist placed the card in front of the participant and waited 20 s for an independent response (at no point did the therapist extend his or her open hand to prompt the participant to exchange a card). After 20 s, the therapist initiated the prompting procedure described for the skills assessment. A correct exchange after any prompt resulted in praise and the item on the card, but the observer scored independent communication only if it occurred during the 20 s prior to the first prompt.

After mastery of the first card, a distracter card depicting an unavailable item (okra) was introduced, and trials continued with the first card and item. Before each session block, the therapist stated the contingencies in place for that block (e.g., "If you hand me the okra card, I will not give you anything. If you hand me the X card, I will give you X."), physically guided the participant through the correct and incorrect responses, and provided the corresponding consequences. Training trials then began as described above. If the child exchanged the card

for the available item, the therapist provided praise and the item. If the child attempted to exchange the distracter card, the therapist blocked the response and delivered the next prompt.

If the participant reached mastery with the distracter added, training began with a second item. The therapist placed two cards and the currently available item in front of the child. One card depicted the item mastered in the previous sessions; the second depicted a new item (the initial distracter card was removed). The therapist stated the contingencies before each session (e.g., "Today we are working for Y [new preferred item]. If you hand me the Y card, I will give you Y. If you hand me the X [previously mastered item] card, I will not give you anything.") and guided the child through each response and consequence. Sessions then continued as described above. Once mastery had occurred with the second card, a third card was added (i.e., the therapist placed three cards in front of the child) and a fourth card following mastery with three cards. During EBC sessions, the therapist acknowledged correct manual signs (e.g., "Nice job signing pretzel, but now we are using cards."), but this rarely occurred during training sessions. Two modifications were made for Tonya following initial failures to acquire the second response after introduction of the distracter. At Session 13, the distracter card was blank to aid in discrimination. At Session 18, only independent responses resulted in reinforcement to aid in motivation.

Manual-sign training. Manual signs were recommended by the unit's speech and language pathologist. They consisted of the appropriate sign in American sign language, but if it was complex (e.g., required two hands moving simultaneously), a functional approximation was used (e.g., the sign "candy" for a Gummy Bear). Prior to each block of three signing sessions, the therapist placed the available item in front of the participant, modeled the sign, and

stated the contingency (e.g., “If you want X, you need to sign X like this.”). The therapist then physically guided the participant to make the sign and delivered the available item. At the start of each trial, the therapist placed the item on the table and waited 20 s for an independent sign. If the participant did not respond or emitted an incorrect response, the therapist followed the prompting procedures as described for the motor-imitation assessment. Unlike the EBC sessions, incorrect attempts were ignored, because it was more difficult to interrupt an incorrect sign than to refuse an incorrect card. The therapist provided praise and the item on the table following a correct sign after any prompt, but observers scored independent communication only if it occurred prior to the first prompt.

Following mastery of the first sign, a second response was introduced and a new item replaced the initial item (as in the EBC sessions, only one item was present at a time). The first session with the new sign began with an explanation of the new contingencies. The therapist informed the participant that he or she was working for a new item and demonstrated the new sign. The participant was then physically guided to make the new sign and provided with the new preferred item. Training trials began immediately after this demonstration. Following mastery of the second sign, a third was introduced, and a fourth sign was introduced following mastery of the third.

Data Collection and Interobserver Agreement

Trained observers used pencil-and-paper event recording to score correct independent responses, incorrect responses, or no response following each prompt. A second observer collected data during 100% of the skills assessments and at least 41% of the training sessions. Agreements were defined as both observers scoring the same outcome following each prompt. Exact agreement coefficients across sessions and participants ranged from 90.5% to 100%.

RESULTS AND DISCUSSION

Dana, Lindsay, and Mark responded correctly during at least 80% of trials during both the matching and motor-imitation assessments, and Tonya, Jacob, and Matt responded correctly on 20% or fewer trials during both assessments. Dana, Lindsay, and Mark later mastered both the manual sign and the EBC responses, generally requiring fewer sessions to master EBC (Figure 1). No other participant mastered independent signing, and even though Jacob's and Tonya's EBC performances remained at chance levels, Matt mastered three EBC responses before being discharged. The results converge with prior research showing that EBC is more rapidly acquired. Also, although the correspondence between motor-imitation and manual-sign acquisition was strong, the correspondence between matching skills and manual-sign acquisition was equally strong, and the correspondence between both assessments and EBC was nearly as strong. Thus, we can conclude only that preexistence of both skills may expedite acquisition of both communicative forms.

Some study limitations should be noted. Baseline sessions were not conducted prior to training, and little information was available on prior training. Prior exposure may therefore have predisposed some participants to acquire the communication systems more rapidly. Future studies may avoid this by testing younger participants without prior exposure to either system. Also, prompting and reinforcement were used during the assessment. Reinforcement was used to help rule out that skills deficits were attributable to a lack of motivation (Lerman, Vorndran, Addison, & Contrucci-Kuhn, 2004), but if learning occurred during assessments, they may not have accurately captured preexisting skill levels. In addition, it is possible that responses were controlled by visual stimuli as well as the motivation to gain them (i.e., they were not pure mands), but joint control of

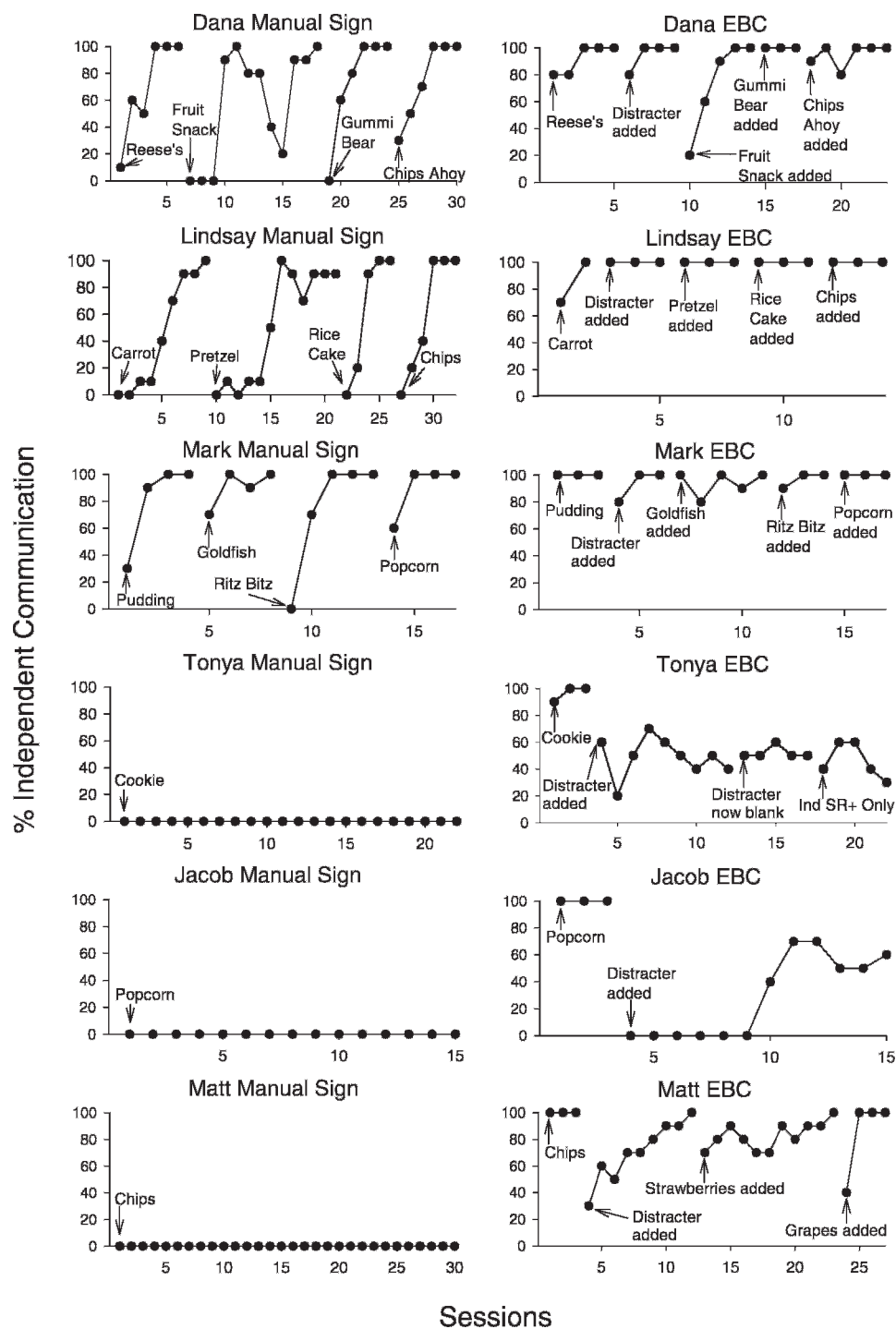


Figure 1. Results of manual sign training (left) and exchange-based communication training (right) for all participants. Each panel depicts the percentage of trials, across sessions, in which the participant displayed independent correct communication for the available stimulus.

this sort may be common in EBC training programs (Bondy, Tincani, & Frost, 2004). Finally, the analyses show only a correlation between the skills and acquisition. Future research may test the functional necessity of the skills by determining if specific skills training (e.g., generalized matching) can enhance acquisition of related communicative responses and test whether other skills (e.g., picture-to-object matching) have greater predictive power.

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